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An empirical test of the Posner argument for transferring health spending from old women to old men

Berlin, November 2010

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ISSN: 1864-6689 (online)

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Is Posner right? An empirical test of the Posner argument for transferring health spending from old women to old men

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November 9, 2010

Abstract

Posner (1995) proposes the redistribution of health spending from old women to old men to equalize life expectancy. His argument is based on the assumption that the woman's utility is higher if her husband is alive. Using self-reported satisfaction measures from a long-running German panel survey, the Socio-Economic Panel Study (SOEP), the present study conducts an empirical test of this assumption. Our matching-based estimation reveals satisfaction trajectories of women who experience the death of their spouse and identifies the causal effect of widowhood. The average level of satisfaction in a control group of non-widowed women serves as a reference to measure the degree of adaptation to widowhood. The results suggest bereavement has no enduring effect on satisfaction, and that is evidence against Posner's assumption.

Keywords: widowhood, adaptation, subjective well-being, life satisfaction, satisfaction with household income, propensity score matching

JEL Classification: C14, D10, I31

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Acknowledgments: We are grateful to Gerhard Krug for valuable comments. We thank participants of seminars at the University of Erlangen-Nuremberg, at the University of Augsburg, of the annual congress of the European Society for Population Economics 2010 in Essen, and of the annual meeting of the Verein für Socialpolitik 2010 in Kiel.

1 Introduction

Economic science aims, among other things, to advise politics and society how to maximize human well-being (or, in economic terms, utility). At the same time, economists show, however, a lack of interest in the empirical foundations of well-being that is excused by a lack of measurability. This leads to a deficit in knowledge about the empirical validity of the assumptions about utility functions used in economic models.

An argument put forward by Richard Posner in his 1995 book, *Aging and Old Age*, could be characterized as suffering from such a knowledge deficit (cf. Posner 1995). His argument is based on the assumption that the woman's utility is higher if her husband is alive (utility of marriage). In conjunction with the empirical fact of an imbalance in the number of elderly men and elderly women, Posner concludes that "keeping the (weaker) male alive another year benefits not only him but also his spouse, by postponing her widowhood" (p. 278). In a formal representation of the Posner argument, Rasmusen (1996) worked out in detail that society's marginal gain from increasing male life expectancy exceeds the marginal loss from reducing that of females. However, the relevance of Posner's policy proposal is not clear unless there is tenable empirical evidence supporting the underlying key assumption about the utility of marriage.

Direct empirical tests of assumptions about utility functions, such as Posner's assumption of the utility of marriage, were not feasible for a long time due to the problem of measuring utility. Over the past 20 years, the developments in the field of happiness research, however, brought out a solution to this problem: modern-day economists are able to use answers to survey questions about people's well-being as a proxy indicator of utility. Substantial overviews of

the approach, which is by now well established in the economic literature, can be found, for instance, in Frey and Stutzer (2002), Layard (2005), Bruni and Porta (2005), and Van Praag and Ferrer-i-Carbonell (2008)

Despite of the recent upsurge in interest in happiness research, a direct confrontation of assumptions about utility with empirical well-being measures is relatively rare in the literature. Therefore, a first contribution of the present study is to demonstrate how observational data on subjective well-being can be utilized to test Posner's assumption about the utility of marriage. In particular, we test empirically whether widowed lifetime has a lower value in terms of utility than otherwise using answers to questions about general life satisfaction and satisfaction with household income. In this way, our study is a contribution to make utility theory and empirical well-being measures compatible.

Second, our study is intended to stimulate discussion about the reference level of well-being that has great importance for assessing the utility of marriage. Different approaches in modeling the reference level may lead to contradictory results, as can be illustrated by examples from recent research: on the one hand, Lucas et al. (2003) showed on the basis of a before-after comparison that the bereaved have, even after 8 years after the spouse's death, a lower level of life satisfaction compared to the level prior to the event. On the other hand, applying a different methodological approach, the same authors found complete adaptation to widowhood in another study (cf. Clark et al. 2008).

As a novel approach, we suggest to evaluate the utility of marriage by imputing the counter-factual level of satisfaction that a widowed woman would have experienced had her partner not died by generating a sample of matched treated (i.e., widowed) and control (i.e., non-widowed)

units, and to use the counterfactual satisfaction as the reference level. A decisive advantage of this approach is that it allows a before-after comparison as well as an identification of the causal effect of the spouse's death. For that purpose, we combine a propensity score matching approach with parametric regression techniques.

Our results indicate that women experience a severe decline in life satisfaction even before the spouse's death. Then, over the four to five years following the event, well-being clearly recovers, though the initial level of life satisfaction is not fully re-established (before-after comparison). From this finding, it cannot, however, be concluded that widowed women are less satisfied with their lives. In fact, they are equally as satisfied as the women in the control group (causal effect). Hence, we infer that bereavement has no enduring effect on utility, and that is evidence against Posner's assumption.

The paper is organized as follows: in Section 2, we briefly review the Posner argument. Section 3 introduces our estimation strategy. The sample design and the estimation results are provided in Sections 4 and 5, respectively, and the last section draws a conclusion.

2 The Posner argument for reallocating health spending

Posner's starting point is the descriptive empirical statement that average life expectancy of women in the United States clearly exceeds that of men. The observation of greater female life expectancy applies, of course, not only to the United States. Figure 1 shows the development of sex-specific life expectancies at birth since the 1960s. In 2006, women regularly have a higher life expectancy than men: in Germany, life expectancy of women exceeds that of men by about 5.2 years on average. For the United States, a similar magnitude of difference is

reported. A detailed analysis of sex mortality differences in the United States can be found in Preston and Wang (2006). In Japan, where, according to statistics from the World Health Organization (2009), life expectancy for women is the highest in the world, there is also a considerable difference (6.8 years) in sex-specific mortality, whereas the gap observed in the United Kingdom (4.3 years) is comparatively small.

Despite the trend of increasing life expectancy of both sexes, the data do not provide an unambiguous picture of the development of the sex gap. While there is evidence that the sex gap has narrowed in the United States and in many European countries (e.g., Gjonca et al. 2005, Robert-Koch-Institut 2007), such a tendency cannot be found in, for example, Japan. Various biological and nonbiological reasons for the sex gap in life expectancy are discussed in the literature (cf. Gjonca et al. 2005). For example, female hormones reduce the risk of heart diseases and degenerative diseases. In contrast, male hormones, particularly testosterone, not only contribute to these diseases, but they also promote hazardous and risky behavior so that a higher frequency of accidental and violent deaths can be detected among men: unhealthy behavior, such as drinking and smoking, is more likely to be observed in males (cf. Waldron 1976). Because such behavior is associated with higher rates of liver cirrhosis and respiratory cancers, for example, they could be partly responsible for the higher male mortality. In addition, more recent research has brought to light the impact of genetic factors on women's longevity (cf. Christensen et al. 2000).

Posner (1995) points out that the higher longevity of women has consequences for health expenditures.[1] Again, the connection between longevity and health expenditures is not only

[1] Posner (1995) actually turns his attention to the "allocation of public funds between research on diseases of old men and research on diseases of old women" (p. 273). In this paper, we refer to these research expenses when we speak somewhat loosely of health expenditures.

valid for the United States, which is Posner's focus, but can also be detected in other countries. In Germany, for example, medical expenses for women are, on average, 1.4 times higher than for men (cf. Robert-Koch-Institut 2007). In 2002, per capita spending amounted to 3,160 Euros for women and 2,240 Euros for men. In particular, costs incurred by diseases of the muscular and skeletal system show an unequal distribution between the sexes.

Because of their higher life expectancy, women are, on average, outliving their husbands. This trend is further augmented by the fact that, in the majority of marriages, women are younger than their spouse (e.g., United Nations 1990). As a result, the incidence of widowhood is higher among women than among men. Figure 2 shows the percentage of widowed men and women by age groups in the UK and Germany, respectively. In all age groups, the relative frequency of being widowed is substantially higher for women than for men. For example, women aged between 75 and 79 are more than twice as often widowed than men.

Starting from the fact of sex differences in life expectancy, Posner examines the question of whether health expenditures should be reallocated between the sexes. More precisely, his analysis looks at a society's marginal utility that results from spending one more dollar on research into men's and women's diseases, respectively. A formal representation of Posner's argument can be found in Rasmusen (1996). The utilitarian position taken has an important consequence for the way the question of how health expenditures should be distributed is discussed. It is not primarily important how many extra life years are achieved by the additional expenditures, but instead it is of greater concern how much utility is produced for women and men. Thus, it is not longevity that is considered as an outcome, but the direct benefit to individuals. Although utility depends on longevity, they are not identical.

The utility assigned to the extra life years gained from the additional expenditure plays the key role in Posner's argument. He assumes that the value of an additional life year depends on the ratio of elderly men to elderly women. When the number of elderly women exceeds that of elderly men, then, by assumption, an additional year of life for women is worth less than for men. Posner (1995) states that "the more women there are *relative to men* [...], the likelier is the value of extending the life of an elderly man by a given amount to exceed the value of extending the life of an elderly woman by the same amount [...], since a scarcity of elderly men increases women's demand for longer male life" (p. 276). Rasmusen (1996) expresses the assumption as follows: "the woman's utility is higher if her husband is still alive" (p. 338). It is important to point out that it is the women themselves who ascribe a lower value to their own life years gained when the ratio of men and women decreases.

Consequently, given the empirical facts of higher female life expectancy and higher female health expenditures in conjunction with the premise that elderly women's utility depends positively on the presence of elderly men, Posner produces a logically correct conclusion: health expenditures should be reallocated so that male life is lengthened. Such redistribution would benefit not only men but also women, because the timing of their widowhood is postponed. (The costs women have to bear consist only of a slight reduction of their life spent widowed.) Posner concludes that "women as a group might benefit from policies that promote greater equality in the number of men and women—for example policies that added a year to female longevity but two years to male longevity" (Posner 1995, p. 277). Hence, women might, under certain circumstances, prefer the relatively shorter extension of their life expectancy.

Rasmusen (1996) points out that the Posner argument remains valid even if one drops the assumption that women's utility is higher when their spouses are alive. The formal proof of

the Posner argument only requires that marginal utility is positive and diminishes with a longer duration of life. In this case, the redistribution from elderly women to elderly men leads to an increase in society's total utility. This holds as long as the life expectancy of women is greater than that of men.

While the empirical evidence related to women's higher life expectancy and the higher health expenditures is, as the remarks at the beginning of this section have shown, entirely uncontroversial and valid not only for the United States, Posner provides, however, no evidence for his assumption that the utility of widowed women is permanently lower compared with that of women whose partner is alive. But it is precisely this point that gives the Posner argument its special charm and persuasiveness: the reduction of expenditures for elderly women would benefit the women because their widowed and, by assumption, less valuable lifetime is postponed and shortened. Although Posner gives some reasons for his opinion that women benefit from increasing male longevity—for example, women may value male companionship, they are more likely to engage in sexual activity when they are married, and they are better off financially—the assumption of higher utility of marriage lacks empirical evidence. Therefore, the aim of the present study is to test empirically the assumption that widowed lifetime is valued lower in terms of utility. We use survey questions about self-reported satisfaction with life in general and with household income to measure utility directly. This method has received general acceptance among economists in recent years (e.g., Frey and Stutzer 2002, Blanchflower and Oswald 2004, Deaton 2008).

3 Estimation strategy

The central aim of the present study is to assess the effect of the spouse's death on the surviving partner's utility, as measured by self-reported satisfaction. The interest lies in the question of whether and to what extent the widowed person's utility responds to such a drastic event. More formally, our attention is on

$$\tau = y^1 - y^0, \tag{1}$$

where y^1 denotes the utility of a widowed individual, and y^0 is the counterfactual outcome, i.e., the utility the individual would have experienced had the spouse not died. We regard the counterfactual outcome as the appropriate reference level against which to compare widowed women's utility. Since we wish to analyze the effect on widowed persons, the relevant measure to answer the research question is the average treatment effect on the treated (ATT), which is defined as

$$E(\tau|W=1) = E(y^1|W=1) - E(y^0|W=1), \tag{2}$$

where

$$W = \begin{cases} 1, & \text{if the spouse's death is observed;} \\ 0, & \text{otherwise.} \end{cases} \tag{3}$$

However, the average outcome for widowed individuals that would be realized had their partner not died, $E(y^0|W=1)$, cannot be observed due to the missing counterfactual outcome.

This problem is known as the fundamental problem of causal inference (cf. Holland 1986). A solution to the problem is to compare the average utility of widowed and non-widowed individuals:

$$E(y^1|W=1) - E(y^0|W=0) = \left[E(y^1|W=1) - E(y^0|W=1)\right] + \left[E(y^0|W=1) - E(y^0|W=0)\right] \tag{4}$$

The difference in utility observed in both groups is, however, only equal to the ATT if there is no selection bias, i.e., when the second term in square brackets in equation 4 is zero. A selection bias occurs when utility of widowed and non-widowed individuals in the base state is different. For example, analyzing the relationship between self-reported life satisfaction and age, Wunder et al. (2009) provide evidence for Germany and Britain that people aged 65 and older experience a substantial decline in satisfaction. In addition, elderly persons are also more likely to experience the death of their partner. Hence it can be assumed, with some plausibility, that widowed persons would also have reported lower satisfaction scores had their partner not died, simply because of the fact that these persons are, on average, older than non-widowed individuals.

A solution to the problem of selection bias is available in the potential outcome approach (cf. Rubin 1974, 2005). The potential outcomes are estimated on the basis of a matching approach: the counterfactual utility of the widowed persons is imputed using control units from a comparison group. We perform matching on the propensity score to generate a comparison group of non-widowed persons who have the same characteristics as the widowed individuals (cf. Rosenbaum and Rubin 1983, 1985). The propensity score $e(\mathbf{x})$ is the conditional probability of being affected by the spouse's death given the covariates. Selecting only individuals

with the same value of the propensity score, it is possible to adjust for differences in the distribution of the observed characteristics $\mathbf{x}$ in the widowed and non-widowed groups. Since it is most unlikely that we will find treated and control units with identical propensity score values, we apply caliper matching. That is, the widowed persons are matched with the nearest control units, where nearness is defined in terms of a certain range of the propensity score.

Because $e(\mathbf{x})$ is unknown, we estimate the propensity score from the available data using a probit regression

$$e(\mathbf{x}) \equiv P(W = 1|\mathbf{x}) = \Phi(\mathbf{x}'\boldsymbol{\beta}), \tag{5}$$

where $\Phi(\cdot)$ denotes the standard normal distribution function. Equation 5 says that the probability of becoming widowed depends on individual characteristics in the vector $\mathbf{x}$. $\boldsymbol{\beta}$ denotes the corresponding coefficient vector. The procedure is available in the Stata ado-file -psmatch2- by Leuven and Sianesi (2003). Only a single match (with replacement) is used because this leads to the most credible inference with the least bias (cf. Imbens 2004).

After matching treated and control units, we selected all person-year observations of these units that were available in the data set. Thus, our definition of the widowed group is such that all observations of an individual whose spouse's death is observed are considered. This approach allows us to estimate the life satisfaction trajectories of widowed persons prior to their spouse's death. In this way anticipation effects, i.e., effects of the spouse's impending death, can be revealed by the ATT as it is defined in equations 2 and 3. Since the control units do not experience the event of their spouse's death, we define a hypothetical treatment for them: it is assumed that, in the matching period, the control units have the same time distance to the

hypothetical treatment as the treated units have to the spouse's death. Figure 3 illustrates this approach.

The comparison of the average life satisfaction of widowed individuals and non-widowed control units is performed using a regression-based approach. The advantage of the combination of matching and regression is that the inferences of the parametric model are less model-dependent compared to a pure regression approach (e.g., Ho et al. 2007). Using the matched sample of treated and control women, we estimate the following parametric regression model:

$$y_{it} = \mathbf{x}'_{it}\boldsymbol{\beta} + \sum_{s=-5}^{6} \gamma_s d_{its} + \sum_{s=-5}^{6} \delta_s D_i \times d_{its} + \alpha_i + \varepsilon_{it}, \tag{6}$$

where y_{it} denotes the response variable of individual i at time t. s indicates the time distance with respect to the event. The year the event occurs is $s = 0$, and $s < 0$ and $s > 0$ are the years before and after the event, respectively. The vector $\mathbf{x}$ refers to a set of standard socio-economic control variables, $\boldsymbol{\beta}$ is the associated coefficient vector. The error component consists of an unobservable individual-specific fixed effect α_i and an idiosyncratic error ε_{it} assumed to be i.i.d. with mean zero.

Equation 6 includes a set of 12 dummy variables, d_{its}, indicating the time periods before and after the event. For example, the dummy variable $d_{it,s=-5}$ takes the value one if the individual i at time t will experience the event five years in the future from that time. All observations made more than five years before (after) the event are subsumed in the first (last) category (i.e., $d_{it,s=-6}$ and $d_{it,s=6}$). The dummy variable indicating the maximum time distance prior to the event, $d_{it,s=-6}$, is chosen as the reference category. The corresponding coefficients γ_s capture a common time trend in the response. The specification further includes a set of interaction

terms that allow inference about differences in the coefficients of widowed women and non-widowed control women. Hence, the coefficients δ_s inform us about the causal effect (ATT) of widowhood on the response variable.

4 Data and sample design

The present analysis uses data from the German Socio-Economic Panel Study (SOEP). The SOEP is a representative longitudinal study of private households that follows the same respondents over time (cf. Wagner et al. 2007).[2] In the SOEP, information over a period of 25 years, from 1984 to 2008, is available. However, we had to discard the years 1990 and 1993 because the information about the respondents' health status is not available in the respective waves. In 1986, the information about disability status was imputed using the value of the preceding year because the relevant question was only in the questionnaire for individuals who had not been interviewed before. Moreover, we excluded widowed women who remarried and women with multiple widowhood spells, because it is undecided whether the married period between the deaths of the consecutive spouses should be considered as a pre- or posttreatment phase.

We use answers to questions about general life satisfaction and financial satisfaction to approximate utility. In the SOEP, the life satisfaction question is expressed as follows: "How satisfied are you with your life, all things considered?" The question about financial satisfaction reads: "How satisfied are you today with the following areas of your life?", where one area

[2] The data used in this paper are extracted using the add-on package PanelWhiz v3.0 for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz-generated do-file to retrieve the SOEP data used here and any PanelWhiz plug-ins are available upon request. Any data or computational errors in this paper are our own. Haisken-DeNew and Hahn (2006) describe PanelWhiz in detail.

refers to household income. The answers are measured on an 11-point scale ranging from 0 (completely dissatisfied) to 10 (completely satisfied).

For both, widowed women and non-widowed women, the median of life satisfaction is seven and the most frequent score (mode) in the sample is 8. The non-widowed females report an average level of life satisfaction of 7.0. In contrast, widowed females assess their life satisfaction, on average, at 6.7 points. A two-group mean-comparison t-test indicates that the difference in life satisfaction between widowed and non-widowed women is highly statistically significant.

Inferences about the causal effect of the spouse's death on the surviving partner's satisfaction should not, of course, be based on these raw data. As alluded to in the preceding section, the lower average satisfaction level of widowed women may simply be the result of the fact that these persons are, on average, older and may be in poorer health, for example. As the widowed women are not similar in characteristics to the non-widowed women, we introduce a comparison group of non-widowed individuals that have the same characteristics by matching on the propensity score.

An overview of the characteristics that were used to estimate the propensity score can be found in Table 1. We regard these variables as important for either the assignment, i.e., the "rule" or mechanism that determines whether a person is widowed or not, or the outcome of interest. It is supposed that the assignment mechanism based on these covariates describes why some individuals become widowed. Hence, the event of the spouse's death is assumed to be random conditional on the propensity score. Since our database, the SOEP, collects information about all members in the household, we are able not only to use the women's characteristics for the analysis, but also to incorporate the variables from their husbands.

The values of the covariates were measured five years prior to the spouse's death, ensuring that the control variables are unaffected by that event. The distribution of the propensity score can be found in Figure 6. After we performed matching on the propensity score using a caliper of 0.005, the t-tests for equality of means of the covariates in the widowed and non-widowed groups are not statistically significant. In addition, the difference in the means is considerably smaller after the matching is applied. The diagnostic analysis of the balancing the covariates is in Table 2.

In the present study, the matching approach is well suited to adjust for the differences in covariates and to remove the bias in the comparison of both groups, because there is a large group of potential control units available. The number of widowed women with non-missing values for all of the control variables amounts to 430 individuals five years before the spouse's death. Since three of these women were not in the region of common support, the treatment group used consists of 427 treated women. From the large reservoir of 97,891 non-widowed control person-year observations of the same sex, 406 best matches were selected (with replacement). That is, 9 control group observations were used twice as the best match, and one control group observations was used three times as the best match.

The full sample consists of all observations preceding and succeeding the matching period so that we are able to describe the trajectories of satisfaction over time (cf. Section 3). The widowed group comprises 7,479 person-year observations, whereas the control group consists of 6,071 person-year observations. The difference in total person-year observations between the treated and control units results from the fact that the best match is not necessarily observed for the same number of waves as the widowed women. Table 3 shows the sample size for both groups with respect to the time of the event.

5 Empirical Evidence

In this section, we begin with an assessment of the conditional independence assumption that is crucial for the validity of the empirical results. After that, we represent the estimated effects of the spouse's death on general life satisfaction and satisfaction with household income. Finally, we assess the persuasiveness of Posner's policy proposal in the light of the empirical evidence.

A key assumption underlying the matching approach is the conditional independence assumption (cf. Lechner 1999). It states that the treatment assignment and the outcome are conditionally independent given the covariates. In the present context, the assumption implies that differences in the satisfaction trajectories of widowed and non-widowed women (with the same characteristics) can be attributed to the event of the husband's death. Although it is not possible to test this assumption directly, its plausibility can be assessed using indirect tests (cf. Imbens 2004). We apply an indirect test using lagged values of the outcome. In particular, we expect that life satisfaction is not affected by the event in the interval prior to the matching period. Since there is in fact no significant difference between the life satisfaction trajectories of widowed and non-widowed women prior to the matching period—the curves shown in Figures 4 and 5 follow an almost identical course and the confidence bands clearly overlap—we regard this as evidence supporting the conditional independence assumption.

In the following, we describe the life satisfaction trajectories of widowed women shown in Figure 4 and discuss the estimation results in Table 4. Two years prior to the event (anticipation phase), we observe a significant decrease in life satisfaction of the widowed women. In comparison, no apparent change in the curve's shape is seen in the control group. This suggests that the spouse's death has a clear impact on the quality of a woman's life before the death

actually occurs. Here, a fatal illness of the spouse, for example, may cause psychological and physical distress for the wife, who is often an informal caregiver (cf. Organisation for Economic Co-operation and Development 2005). The caregiver spouse lacks social support from the sick spouse and, in addition, may be socially isolated because of the caring responsibilities (cf. Williams 2004). This situation in the years preceding the spouse's death may be held responsible for the downward trend in life satisfaction. The causal effect of the spouse's death in the anticipation phase is estimated to be approximately 0.5 points.

In the year of the spouse's death, the loss of life satisfaction is most severe. Widowed women experience a decline in satisfaction of more than 1.5 points on the 11-point scale, on average. In the succeeding phase, after the death of the spouse, a restoration effect leads to a rapid improvement in life satisfaction. Restoration is almost as intense as deterioration was before the event. Four to five years after the event, virtually no significant difference between the life satisfaction of widowed and non-widowed women can be detected. In particular, we do not find any evidence for lower life satisfaction of widowed women after six years. The estimate of the coefficient of the corresponding interaction term has a small value and is insignificant (cf. Table 4). Hence, on a medium-term basis, the level of life satisfaction of widowed women is no different from that of non-widowed women.

An explanation for the restoration effect can be seen in adaptation. In this sense, the restoration effect on life satisfaction can be understood as a reaction to the altered circumstances. For example, the surviving spouse has to take over the task of household management and financial responsibilities that were previously handled by the deceased spouse (e.g., Utz et al. 2004, Ha et al. 2006). Therefore, we suppose that the restoration in life satisfaction results from the successful adaptation of the surviving partner to these responsibilities. The evidence for an

adaptive process found in the present study does not, however, support the set-point theory of well-being—a concept put forward by Brickman and Campbell (1971) and criticized recently, e.g., by Headey et al. (2010)—because the satisfaction level observed prior to the event is not fully recovered. Life satisfaction of widowed women is, even in the long term, lower after their spouse dies.

Next, we discuss whether and to what extent satisfaction with household income is affected by the spouse's death. The financial satisfaction trajectories are graphically represented in Figure 5 and the estimation results are in Table 5. Contrary to the case of general life satisfaction, we do not detect anticipation effects in the trajectories of financial satisfaction. Even in the year before the event, there is no significant difference between the treatment and the control group. However, a statistically significant reduction in financial satisfaction of 0.4 points occurs in the year of the spouse's death. This decline can only to a small extent be explained by a change in socio-economic background characteristics: a model that controls for, among other things, household size and household income still points to a difference of 0.3 points in financial satisfaction between widowed women and non-widowed women. Hence, we find that widowed women are less financially satisfied than non-widowed women who have the same household income (given the household size). Possibly, the above-mentioned change in financial responsibilities and a subjectively perceived uncertainty regarding the future are responsible for the negative effect. The widowed women, however, return promptly to the reference level of the control group women. As early as one year after the event, no significant difference in financial satisfaction is diagnosed.

Finally, the analysis leads us to an assessment of the Posner argument for transferring health spending from old women to old men. The key assumption of Posner and Rasmusen is that

utility derived from married lifetime is higher than utility from widowed lifetime. From our empirical analysis, we infer that the hypothesis is right as far as the utility or satisfaction level prior to the event of the spouse's death is concerned: the widowed women do not reach this level again. However, the widowed women are, on a medium-term basis, no less satisfied with their life than non-widowed women (with the same characteristics). The fact that there is no treatment effect observed approximately four years after the event of the spouse's death results from the slight gradual decline in satisfaction that takes place in the control group. Possible reasons for this finding may be seen in an age-related deterioration of health, for example. A detailed discussion of the underlying reasons is, however, beyond the scope of the present study. After all, the empirical evidence presented in this study is evidence against Posner's assumption about the utility of marriage. Although this does not refute Posner's considerations as a whole, his argument loses, to a large degree, the power of its persuasiveness.

6 Conclusion

Posner advocates an allocation of health-care resources such that society's utility is increased. To attain this aim, he proposes transferring health spending from old women to old men to equalize life expectancy. His considerations are based on the assumption that bereaved women experience lower utility compared with that experienced in life with a partner. The policy relevance of Posner's argument, however, remains unclear until the validity of his assumption is empirically tested. In the present study, we used data on self-reported satisfaction from the SOEP to conduct an empirical test of Posner's premise: are widowed women less satisfied with their lives? In this way, our study demonstrated how self-reported satisfaction can be used as

a measure of utility to test key assumptions of policy proposals inspired by neoclassical utility theory.

Our propensity-score-matching-based estimation strategy identified a causal effect of widowhood on utility, as measured by self-reported satisfaction. In particular, we estimated the counterfactual level of satisfaction of widowed women on the basis of a control group of non-widowed women with the same characteristics. After that, we performed the comparison of treated and control units using parametric regressions.

Our study brought to light that Posner's assumption is right in the sense that widowed women are, in the long run, not as satisfied with their lives as at the time they were married. This observation is, however, not attributable to the marital transition and the spouse's death. Rather, our analysis indicates that widowed women experience, after they have adapted to the new situation, similar levels of life satisfaction to those of comparable non-widowed women. Therefore, we revealed Posner's assumption to be false: widowed women are, on a mid-term basis, no less satisfied with their lives. This finding also calls into question Posner's argument for transferring health spending from old women to old men as a policy to improve women's well-being (or utility). Our analysis gives rise to the supposition that elderly women would not benefit from Posner's policy proposal.

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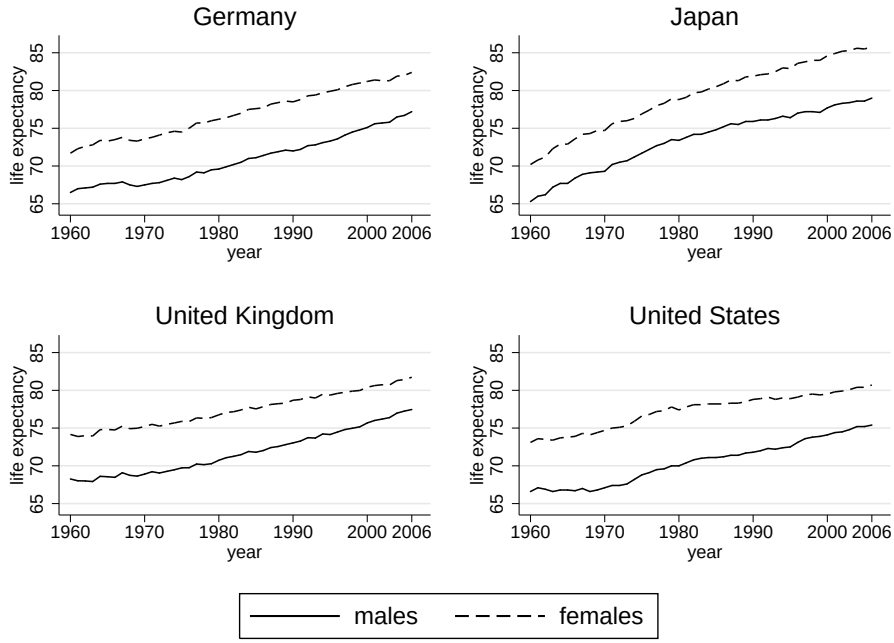
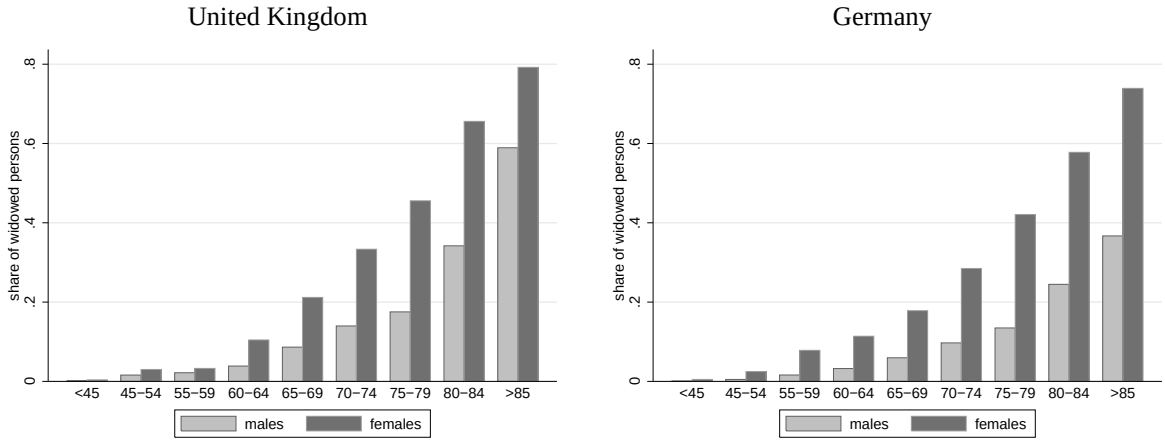
Figures

Figure 1
Sex-specific life expectancy in four countries



Source: Data for Germany, Japan, and the United States are from Organisation for Economic Co-operation and Development (2009). Data from United Kingdom are from the Human Mortality Database, University of California, Berkeley (USA), and the Max Planck Institute for Demographic Research (Germany), available at *www.mortality.org* or *www.humanmortality.de* (data downloaded on 7 March 2009).

Figure 2
Percentage of widowed persons by sex and age group in 2007



Source: British Household Panel Survey (BHPS) 2007, German Socio-Economic Panel Study (SOEP) 2007.

Figure 3
Matching of control and treatment units

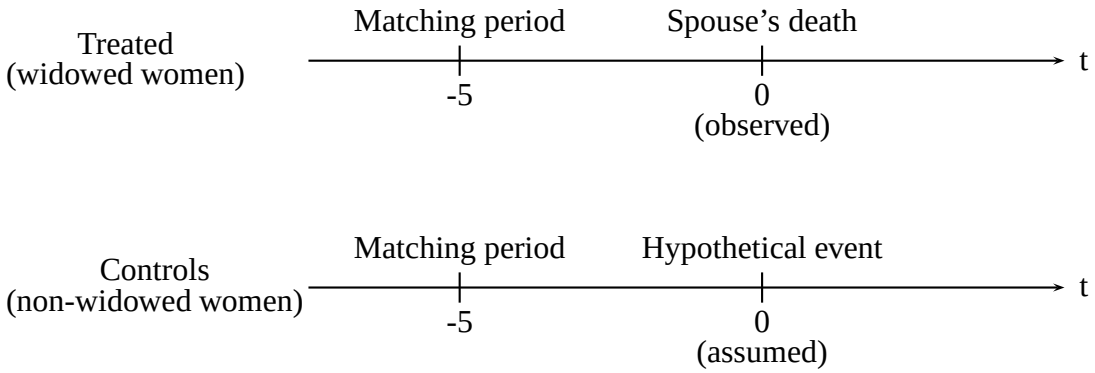
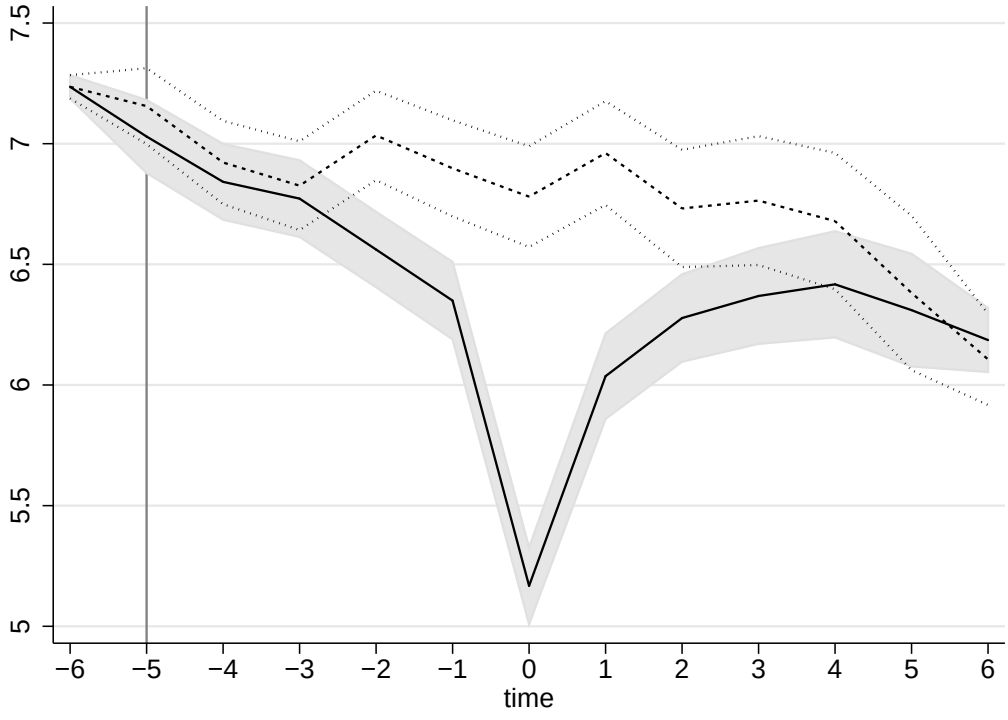
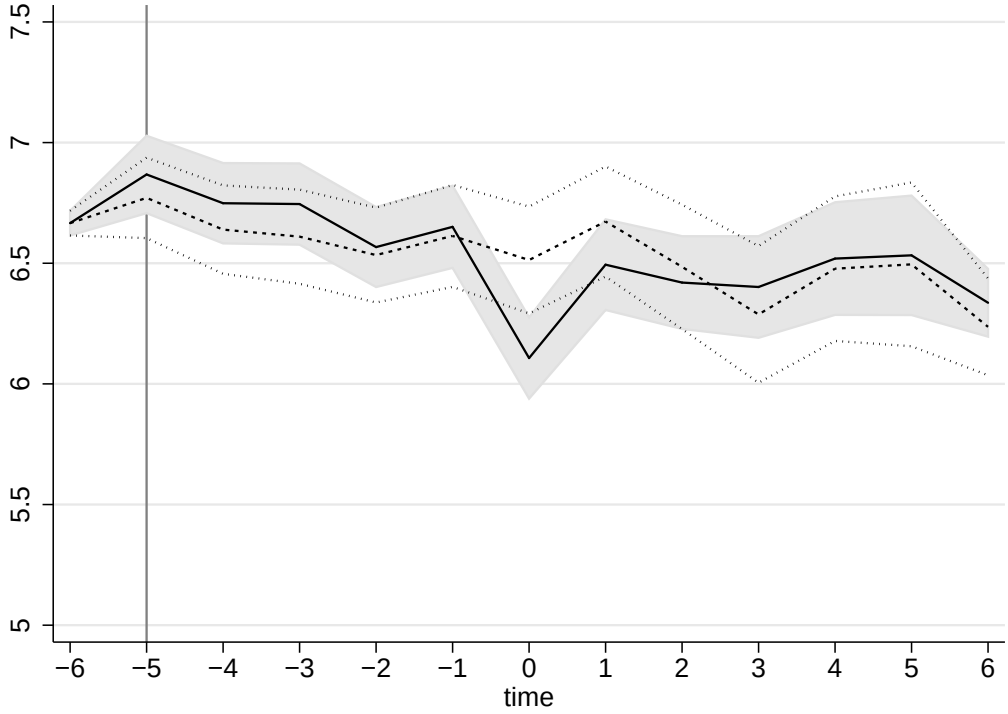


Figure 4
Trajectories of female life satisfaction



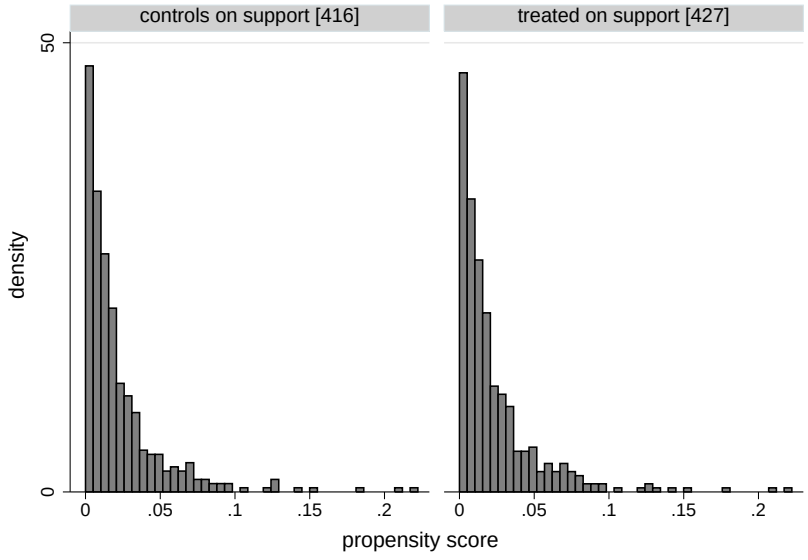
Note: The vertical line indicates the matching period. The shaded area and dotted lines show 95% confidence bands for the expected value of life satisfaction of widowed women and control units, respectively.
Source: SOEP 1984-2008 (without 1990, 1993)

Figure 5
Trajectories of female satisfaction with household income



Note: The vertical line indicates the matching period. The shaded area and dotted lines show 95% confidence bands for the expected value of life satisfaction of widowed women and control units, respectively.
Source: SOEP 1984-2008 (without 1990, 1993)

Figure 6
Common support



Tables

Table 1
Characteristics used in the matching

Characteristic	Description
Women	
Life satisfaction	The variable is measured on an 11-point scale (see text).
Financial satisfaction	Satisfaction with household income is measured on an 11-point scale. An interaction term with life satisfaction is also considered.
Average values of life satisfaction and financial satisfaction	To ensure that treated and control units are comparable not only with respect to life satisfaction in the matching period, we also included a moving average of the levels of life satisfaction using the three preceding years.
Marriage history	Number of years married
Age	A second order polynomial of age is used.
Health status	The health status is captured using information about the number of doctor visits.
Income	Household income
Education	Number of years of education
Household size	Number of persons living in the household
Nationality	A dummy variable indicating whether the woman is German
Panel year	Dummy variables for the year of the interview
Spouse	
Life satisfaction	Defined as above
Education	Defined as above
Age	Defined as above
Health status	Defined as above

Table 2
Covariate balance

Variable	Matching	Widowed	Control	Standard. bias	Bias re-duction	t	p>|t|
Women's characteristics							
Life satisfaction	Before	6.9977	7.09	-5.1		-1.08	0.282
	After	7.0047	7.0281	-1.3	74.6	-0.19	0.850
Avg. life satisfaction	Before	6.9977	7.173	-10.3		-2.43	0.015
	After	7.0047	6.9628	2.5	76.1	0.36	0.717
Financial satisfaction	Before	6.7233	6.5455	8.2		1.67	0.096
	After	6.7166	6.822	-4.8	40.7	-0.74	0.462
Avg. financial satisfaction	Before	6.7233	6.5739	7.3		1.60	0.110
	After	6.7166	6.7627	-2.3	69.1	-0.34	0.734
Interaction: life/fin. sat.	Before	49.107	48.424	2.9		0.62	0.537
	After	49.133	49.513	-1.6	44.5	-0.24	0.809
Years married	Before	36.474	22.959	100.9		19.73	0.000
	After	36.501	36.276	1.7	98.3	0.25	0.801
Age	Before	61.316	47.012	113.3		21.61	0.000
	After	61.314	61.131	1.4	98.7	0.23	0.817
Age squared	Before	3890.5	2398	110.6		22.61	0.000
	After	3890.5	3870.5	1.5	98.7	0.22	0.830
Education (years)	Before	10.379	11.328	-42.1		-7.82	0.000
	After	10.375	10.303	3.2	92.5	0.55	0.583
Number of doctor visits	Before	14.893	11.469	17.8		4.06	0.000
	After	14.979	15.307	-1.7	90.4	-0.23	0.815
Household income	Before	2222.4	2809.7	-40.2		-6.93	0.000
	After	2220.7	2193.7	1.8	95.4	0.35	0.723
Household size	Before	2.4907	3.1788	-66.5		-11.68	0.000
	After	2.4941	2.5059	-1.1	98.3	-0.20	0.842
German nationality	Before	.89535	.80039	26.7		4.92	0.000
	After	.89461	.89227	0.7	97.5	0.11	0.912
Spouse's characteristics							
Life satisfaction	Before	6.6977	7.0696	-18.6		-4.40	0.000
	After	6.7447	6.7588	-0.7	96.2	-0.10	0.917
Education (years)	Before	11.101	11.922	-33.0		-6.17	0.000
	After	11.107	11.158	-2.1	93.7	-0.36	0.723
Age	Before	65.058	49.779	120.9		22.94	0.000
	After	64.974	64.927	0.4	99.7	0.06	0.953
Number of doctor visits	Before	17.637	9.5256	37.4		9.89	0.000
	After	17.677	19.063	-6.4	82.9	-0.65	0.513

Source: SOEP 1984-2008 (without 1990, 1993).

Table 3
Sample size with respect to time distance to event

Time distance to event	Control units	Widowed women	Total
-6 and less	2,872	2,728	5,600
-5	416	427	843
-4	371	421	792
-3	333	425	758
-2	303	426	729
-1	284	427	711
0	265	427	692
1	226	357	583
2	190	315	505
3	157	263	420
4	130	220	350
5	100	176	276
6 and more	424	867	1,291
nT	6,071	7,479	13,550

Source: SOEP 1984-2008 (without 1990, 1993).

Table 4
Estimation results: life satisfaction

	Model without controls		Model with controls	
Variable	Coef.	s.e.	Coef.	s.e.
Time distance to event				
-5	-0.080	(0.081)	0.140*	(0.084)
-4	-0.314***	(0.089)	-0.076	(0.092)
-3	-0.410***	(0.094)	-0.113	(0.099)
-2	-0.201**	(0.095)	0.147	(0.102)
-1	-0.338***	(0.102)	0.049	(0.110)
0	-0.455***	(0.107)	-0.011	(0.116)
1	-0.275**	(0.110)	0.193	(0.121)
2	-0.504***	(0.124)	0.009	(0.136)
3	-0.472***	(0.136)	0.084	(0.148)
4	-0.557***	(0.143)	0.110	(0.157)
5	-0.854***	(0.162)	-0.158	(0.176)
6 and more	-1.130***	(0.099)	-0.318**	(0.134)
Interaction terms:				
-5	-0.126	(0.114)	-0.148	(0.113)
-4	-0.080	(0.122)	-0.077	(0.120)
-3	-0.054	(0.126)	-0.072	(0.124)
-2	-0.473***	(0.126)	-0.481***	(0.124)
-1	-0.548***	(0.133)	-0.549***	(0.131)
0	-1.613***	(0.136)	-1.628***	(0.142)
1	-0.925***	(0.144)	-0.944***	(0.150)
2	-0.454***	(0.156)	-0.468***	(0.162)
3	-0.395**	(0.171)	-0.384**	(0.176)
4	-0.262	(0.183)	-0.311*	(0.188)
5	-0.071	(0.202)	-0.120	(0.206)
6	0.080	(0.124)	0.148	(0.132)
Age	—		-0.327***	(0.059)
Age squared	—		0.005***	(0.001)
Age/10 cubic	—		-0.033***	(0.006)
Years of education	—		0.045	(0.030)
Log of net household income	—		0.370***	(0.058)
Log of household size	—		-0.274***	(0.093)
Disability status: disabled	—		-0.284***	(0.066)
Number of annual doctor visits	—		-0.009***	(0.001)
Number of nights in hospital	—		-0.007***	(0.001)
Unemployed	—		-0.401***	(0.092)
Working	—		-0.102*	(0.055)
West Germany	—		0.038	(0.363)

Note: The table reports results from individual fixed effects estimations using the sample of matched widowed and non-widowed control women. Time distance -6 years to the event is the reference category. Significance level: *<0.1, *<0.05, ***<0.01.
Source: SOEP 1984-2008 (without 1990, 1993).

Table 5
Estimation results: satisfaction with household income

	Model without controls		Model with controls	
Variable	Coef.	s.e.	Coef.	s.e.
Time distance to event				
-5	0.105	(0.086)	0.188**	(0.087)
-4	-0.027	(0.094)	-0.004	(0.096)
-3	-0.056	(0.100)	0.005	(0.104)
-2	-0.132	(0.101)	-0.072	(0.107)
-1	-0.053	(0.108)	0.038	(0.115)
0	-0.153	(0.113)	-0.076	(0.122)
1	0.007	(0.117)	0.095	(0.127)
2	-0.181	(0.131)	-0.105	(0.142)
3	-0.378***	(0.144)	-0.267*	(0.155)
4	-0.189	(0.152)	-0.061	(0.164)
5	-0.171	(0.172)	0.001	(0.184)
6 and more	-0.430***	(0.105)	-0.316**	(0.140)
Interaction terms:				
-5	0.097	(0.121)	-0.000	(0.118)
-4	0.109	(0.129)	0.087	(0.125)
-3	0.135	(0.134)	0.084	(0.130)
-2	0.033	(0.134)	-0.004	(0.130)
-1	0.038	(0.141)	-0.035	(0.137)
0	-0.406***	(0.144)	-0.290*	(0.148)
1	-0.179	(0.153)	-0.133	(0.157)
2	-0.065	(0.166)	0.025	(0.169)
3	0.114	(0.181)	0.193	(0.184)
4	0.042	(0.194)	0.074	(0.196)
5	0.037	(0.215)	0.012	(0.215)
6	0.100	(0.131)	0.141	(0.138)
Age	—		-0.399***	(0.062)
Age squared	—		0.006***	(0.001)
Age/10 cubic	—		-0.034***	(0.006)
Years of education	—		-0.022	(0.031)
Log of net household income	—		1.481***	(0.061)
Log of household size	—		-0.658***	(0.097)
Disability status: disabled	—		-0.067	(0.069)
Number of annual doctor visits	—		-0.002***	(0.001)
Number of nights in hospital	—		0.000	(0.001)
Unemployed	—		-0.678***	(0.096)
Working	—		-0.066	(0.057)
West Germany	—		0.037	(0.380)

Note: The table reports results from individual fixed effects estimations using the sample of matched widowed and non-widowed control women. Time distance -6 years to the event is the reference category. Significance level: *<0.1, *<0.05, ***<0.01.
Source: SOEP 1984-2008 (without 1990, 1993).